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In Austin's herbarium there is an autograph specimen from James, which is probably the one referred to in the BULLETIN (l. c.), labelled *O. obtusifolium*, Drummond's No. 157, on which Austin has written: "equals *O. brachytrichum*, Sch., of course it is *O. obtusifolium*," as undoubtedly it is, James having sent him only a part of Drummond's 157, and not the same as that he sent Schimper. The specimen of *O. obtusifolium* collected by Austin in Jordansville Swamp, New York, 1868, above referred to, has both acute and obtuse leaves on the same plants. These helped him, also, to confuse the two species.

Unequal Segmentation and Its Significance in the Primary Division of the Embryo of Ferns.

BY GEO. F. ATKINSON.

In studying the embryos of several species of the Polypodiaceæ, sections were obtained of the primary division which suggested the possibility of some fundamental law governing unequal segmentation of the egg, in some species at least. In finishing a camera lucida sketch of an embryo of *Pteris serrulata* I noted what at first was not observed, the two cells with their nuclei were of unequal size. Thinking some error might have arisen in connection with the first sketch the preparation was examined again, when it was easy to note the smaller size of the nucleus in the smaller anterior segment. . Measurements with the micrometer showed that the diameter of the nucleus in the posterior segment was one-fourth to one-fifth greater than that of the anterior segment.

If this state of things were reasonably constant it would show a definite relation existing between the primary segmentation and the different functions of the two segments. That is to say, the nucleus of the egg first divides into two unequal nuclei, an anterior one smaller than a posterior one; that these unequal nuclei govern the size of the two primary segments of the embryo by which that part of the plant chiefly concerned in supplying nutriment, the root segment, is differentiated from that part chiefly concerned in the reproductive function, the stem segment. This is important from the fact that at the start the embryo is wholly dependent upon the prothallium for its nutriment.

The posterior segment, being the larger, presents a much greater absorbent surface over the prothallial tissue, and by subsequent growth and cell division more quickly reaches the extended surface characteristic of the foot in the early stage of the embryo.

For some time in the later divisions of the embryo, the tissue derived from the posterior segment exceeds in bulk that derived from the anterior segment. This is recognized as bearing a definite relation to the function of the different parts of the embryo. Why should not the impulse to this rational differentiation in the young tissues of the embryo exist in the egg and be manifested in the primary unequal division as seen in this example of *Pteris serrulata?* Another case was found in the embryo of *Adiantum cuneatum;* the anterior segment with its nucleus was smaller than that of the posterior segment. Goebel, Outlines of Classification and Special Morphology of Plants, p. 204, figures an embryo of *Adiantum Capillus-veneris* showing the anterior segment much smaller than the posterior segment. The nuclei are not shown, and he gives no explanation of the unequal size of the two segments. If the section were not perpendicular to the first division-wall, but oblique to it, the size of the cells might vary according to the focus plane of the microscope or the position of the section in the embryo. In the specimens of *Pteris serrulata* and *Adiantum cuneatum,* referred to above, it was especially noted that the primary division wall was perpendicular to the section. This added to the fact that the nuclei were unequal in size is conclusive that the stem segment was smaller than the root segment.

A few cases only would not be sufficient evidence to warrant the assumption that a general law of this nature exists, but it seems to me that it is sufficiently strong to warrant an enquiry as to its significance. It is desirable that an examination be made of a number of embryos showing the primary division, with a view to see how far this unequal segmentation will hold good. The fact that in the Polypodiaceæ the foot is much more highly developed than in the lower orders of ferns would seem to favor the possibility of there being a primary unequal segmentation of the embryo.

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Two Perfectly Developed Embryos on a single Prothallium of Adiantum cuneatum.

BY GEO. F. ATKINSON.

It is well known that several archegonia on a single prothallium of the ferns may possess fertilized eggs. In some cases more than one of them is known to begin embryological development, but it is quite rare that more than one becomes a perfectly developed embryo capable of forming an independent plant. The statement is sometimes made that while several archegonia may possess fertilized eggs never more than one embryo is perfectly developed.

Heinricher,[*] in lighting prothallia both above and below, succeeded in causing the development of archegonia in numbers on both surfaces. In two cases two archegonia possessed fertilized eggs which developed into perfect embryos, one each above and below. This might be considered an abnormal condition induced from the peculiar condition of lighting.

Rauwenhoff[†] notes the development of two embryos on single prothallia of *Gleichenia.* In both of these cases, however, we are not informed of the comparative strength or advanced condition of growth of the embryos, so that it may be an open question whether both of the embryos on a single prothallium could have developed into independent plants.

Campbell[‡] also observes two embryos on a single prothallium of Osmunda, but states that one was far in advance of the other, and would probably have starved it out before the two could obtain foothold in the soil.

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[*] Heinricher, Beeinnflusst das licht die Organ Auflage am Farn Embryos, Mitt heilungen des bot. Inst. zu Graz, Heft II., pp. 239–253.

[†] Rauwenhoff, De geslechtsgeneratie der Gleicheniaceen. Verh. d. Koninkl. Akad. van Wetensch. t. Amsterdam, 1889.

[‡] Campbell, On the Prothallium and Embryo of *Osmunda Claytoniana* and O. *cinnamomea*, Ann. Bot. vi., 1892, 49–94.